UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/553,573	10/17/2005	Christian Dussarrat	Serie 6070	1576

40582 7590 04/04/2011

American Air Liquide, Inc.
Intellectual Property Dept.
2700 Post Oak Boulevard
Suite 1800
Houston, TX 77056

EXAMINER	
BURKHART, ELIZABETH A	

ART UNIT	PAPER NUMBER
1715	

MAIL DATE	DELIVERY MODE
04/04/2011	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/553,573	DUSSARRAT ET AL.	
	Examiner	Art Unit	
	ELIZABETH BURKHART	1715	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 January 2011*.

2a)☐ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *36-49* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *36-49* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *1/28/11*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 36-49 are pending in the application. Cancelled claims 1-35 and new claims 36-49 have been noted. The amendment filed 1/28/2011 has been entered and carefully considered.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 44 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Buchanan et al (US 2003/0203653).

Buchanan discloses a method of forming silicon nitride comprising: maintaining a reaction chamber at a pressure of 1 mtorr to 500 torr and a temperature of 400-900°C, reacting a gas comprising trisilylamine with a gas comprising a hydrazine in the chamber, and forming a silicon nitride film on the substrate by LPCVD (Abstract, [0017], [0032], [0034]). The subject matter as a whole would have been obvious to one of ordinary skill in the art at the time of invention by applicant if the overlapping portion of the pressure and temperature ranges disclosed by the reference were selected because overlapping ranges have been held to be a prima facie case of obviousness, see In re Wortheim 191 USPQ 90.

Thus, claims 44 and 45 would have been obvious within the meaning of 35 USC 103 over the teachings of Buchanan.

3. Claims 36, 38-42, and 46-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al (US 2001/0048973) in view of Buchanan et al (US 2003/0203653).

Sato teaches a method of producing a silicon nitride film by CVD comprising: feeding a hydrazine gas (e.g. 1,1-dimethylhydrazine) and a silicon-containing precursor gas into a reaction chamber wherein a substrate is located within said reaction chamber and forming a silicon nitride film on said substrate by reacting said hydrazine gas with said silicon-containing precursor gas [0030]-[0037]. The reaction between the silicon-containing precursor and hydrazine gas may occur in a synthesis chamber [0017] such that the gas mixture may be stored and introduced to the reaction chamber at a desired time [0054].

Sato does not disclose that the silicon-containing precursor is trisilylamine such that a silylhydrazine is formed.

Buchanan discloses a method of forming silicon nitride comprising: maintaining a reaction chamber at a pressure of 1 mtorr to 500 torr and a temperature of 400-900°C, reacting a gas comprising trisilylamine (TSA) with a gas comprising a hydrazine in the chamber, and forming a silicon nitride film on the substrate by LPCVD (Abstract, [0017], [0032], [0034]). TSA enables a lower temperature route to formation of a SiN film via LPCVD [0035].

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to use trisilylamine as suggested by Buchanan as the silicon-containing precursor in Sato since it enables a lower temperature route to formation of a SiN film.

Regarding Claims 38 and 39, Sato discloses the temperature during the CVD process is 500°C-800°C and the pressure is 0.1-760 torr [0036]. Buchanan discloses a pressure of 1 mtorr to 500 torr and a temperature of 400-900°C [0017].

Regarding Claims 40 and 46, Sato discloses that an inert gas may be fed to the reaction chamber as a carrier gas (Ex. 1).

Regarding Claims 41, 42, 47, and 48, Sato discloses that the hydrazine may be 1,1-dimethylhydrazine [0034]. The reaction between TSA of Buchanan with the hydrazine of Sato would inherently form disilylmethylhydrazine.

Thus, claims 36, 38-42, and 46-48 would have been obvious within the meaning of 35 USC 103 over the combined teachings of Sato and Buchanan.

4. Claims 37, 43, and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al (US 2001/0048973) in view of Buchanan et al (US 2003/0203653) as applied above and further in view of Wang et al (US 2004/0194706).

Sato and Buchanan do not disclose a step b) i) of feeding a hydrazine gas into the reaction chamber prior to and/or during step c).

Wang discloses forming a silicon nitride layer by LPCVD comprising reacting silylhydrazine with a hydrazine gas, wherein the hydrazine gas may be used to control composition of the deposited layer [0024], [0039], [0043], [0063].

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to introduce a hydrazine gas as suggested by Wang into the reaction chamber of Sato along with the gas mixture from the synthesis chamber (e.g. TSA + hydrazine as suggested by Buchanan) in order to control the composition of the deposited SiN film.

Regarding Claims 43 and 49, Wang discloses a hydrazine/precursor flow ratio of 1 to 1000 [0045]. Further, it would have been obvious to use 1,1-dimethylhydrazine as suggested by Sato since it was a known hydrazine for forming silicon nitride films.

Thus, claims 37, 43, and 49 would have been obvious within the meaning of 35 USC 103 over the combined teachings of Sato, Buchanan, and Wang.

Response to Arguments

5. Applicant's arguments filed 1/28/2011 have been fully considered but they are not persuasive. Applicant argues that since precipitating reaction products are not generated by trisilylamine reactions with hydrazines, there would be no motivation to use the preliminary chamber of Sato. The examiner disagrees. Sato discloses that an advantage of using their preliminary chamber is that the precursor formed may then be stored such that it can be introduced to the reaction chamber at a desired time [0054]. Thus, it would have been obvious to use the preliminary chamber of Sato even when using trisilylamine and hydrazine as the precursor gases in order to store the gas mixture and introduce such to the reaction chamber at a desired time.

Applicant argues that while Sato discloses pressure ranges encompassing LPCVD, the examples given are well above the 10 torr limit now claimed and the silicon-

containing precursors are unrelated to trisilylamine. Sato discloses pressure ranges which include LPCVD (0.1-760 torr) [0036]. Therefore one of ordinary skill would reasonably expect to deposit SiN over the entire range given, including LPCVD. Further, Buchanan discloses reacting trisilylamine with a hydrazine to form SiN using LPCVD wherein the pressure may be 1 mtorr to 500 torr [0017]. Therefore, one of ordinary skill would have reasonably expected to form SiN using LPCVD, wherein trisilylamine is used as a precursor, given the pressure range disclosed in Buchanan.

Conclusion

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ELIZABETH BURKHART whose telephone number is (571)272-6647. The examiner can normally be reached on M-Th 7-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on 571-272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Elizabeth Burkhart/
Examiner, Art Unit 1715

/Timothy H Meeks/
Supervisory Patent Examiner, Art Unit 1715